TECHNICAL BULLETIN *Prepared by the Davey Institute*

Climate Change Projections for the U.S. Southern Great Plains

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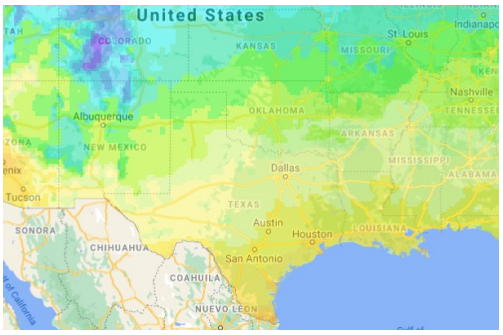
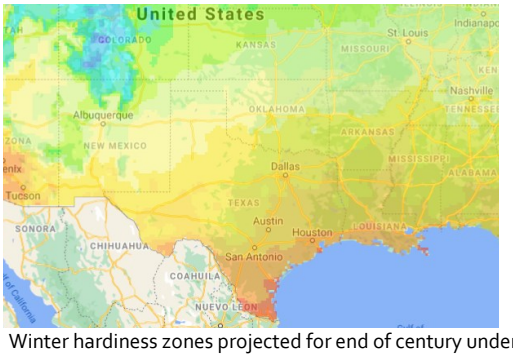
Image from Fourth National Climate Assessment

The Davey Climate Change Fact Sheet Series projects the future impacts of climate change in our industry over the next 30-70 years, with emphasis on changes in temperature, precipitation, storm intensity, tree health, pest pressure, wildfire, and worker stress. Temperatures across the U.S. are expected to increase between 3-11°F by the end of this century, with future patterns of greenhouse gas emissions providing the largest source of uncertainty. The Intergovernmental Panel on Climate Change (IPCC) predicts future climates based on modeling for different emissions scenarios, called "Representative Concentration Pathways (RCP)." This fact sheet focuses on changes expected to occur in the U.S.Southern Great Plains based on a lower (RCP4.5) and higher (RCP8.5) emissions scenarios. Currently, global patterns of fossil fuel consumption correspond most closely with the high emission scenario, while the lower emission scenario will require significant mitigation measures yet to be implemented.

The climate is warming. The Southern Great Plains states have warmed 1-2°F over the last 100 years, with winters warming more than summers. Compared with the average from 1976-2005, warming throughout the region is projected to intensify in coming years, with temperatures increasing by 3.6-5.1°F by mid-century and 4.4 to 8.4°F by the end of the century under the lower and higher emissions scenarios, respectively. Temperatures greater than 86° can negatively affect plant photosynthesis, and, subsequently, plant growth and health. By mid-century, days above this threshold are expected to increase by an average of 26 and 54 days from the baseline period 1980-2009 under low and high scenarios across the region. With increasing temperatures, plant hardiness zones are transitioning. By mid-century, mean minimum temperature will have increased by 3.8°F (low scenario) and 5.8° (high scenario), on average throughout the region.



Current winter hardiness zones



Winter hardiness zones projected for end of century under the lower emission scenario

A looming water crisis

Average precipitation is projected to decline slightly during summer and increase slightly during winter. A greater proportion is falling in fewer events during downpours and this trend is projected to increase, with longer dry spells between rains. Soils are becoming drier as warmer temperatures increase evapotranspiration. More evaporation and less summer precipitation in recent decades have decreased flow of rivers throughout the region including the Rio Grande.

Furthermore, ground water is being depleted in the High Plains Aquifer System in much of Kansas and the Oklahoma panhandle, where levels have been depleted 25% by agricultural irrigation since the 1950s. A growing population and more frequent droughts will increase pressure on the Edwards Aquifer, on which much of central Texas is dependent for their water supply. These trends are projected to amplify and impose constraints on municipal water supplies that could result in irrigation restrictions. This would present challenges for maintaining tree health even as their physiological demands for water are amplified by increasing temperatures and evapotranspiration.

Water management and tree health care.

As plant growth begins earlier in the spring and summers become hotter and extreme heat more frequent, soil is becoming drier with increasing evapotranspiration. These trends will intensify stress experienced by trees, resulting in their increased susceptibility to secondary pests such as wood-borers, vascular wilt and canker pathogens, especially in the southern portions of this region. Increased degree-day accumulation is resulting in insect pests increasing their reproductive rates and number of generations per year; warmer temperatures will also lead to new pest species migrating north into the region.

Hurricanes, sea level rise, and coastal flooding

The number of hurricanes that form in the Gulf of Mexico each year is highly variable and there is little evidence of a change in frequency over time. However, hurricanes draw their energy from the heat of the ocean, which is warming. The frequency of strong hurricanes (class 4 and 5) and associated extreme precipitation and flooding has increased substantially, bringing with it significant economic impact.

This trend is predicted to intensify, with major implications for the tree care industry and utilities. Relative sea level in the Texas Gulf coast has been rising at twice the global average rate, while frequency of flooding at high tide has increased 5- to 10-fold over the past 50 years.

Human health: increased exposure to extreme heat

As the climate warms, people that work and recreate outside will experience greater risk of heat stress. For example, by the second half of the century the number days above 100°F is expected to increase four-fold throughout the region, totaling 30-60 and 40-100 days under the lower and higher emission scenarios, respectively, with the greatest impact in southern Texas. Extreme heat stress is particularly dangerous when it exasperates other conditions such as dehydration and cardiovascular and respiratory stress. High temperatures also increase the concentration of ground-level ozone, which stresses trees by decreasing their growth and resistance to insects and disease. The frequency of high ozone days is projected to increase, especially in urban areas.

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